

What is claimed is;

1. An image processing method of making a monochromatic image signal made up of image signal components representing image data on respective pixels from a color image signal made up of image signal components representing image data on respective pixels, the method characterized in that

values of brightness of pixels in a color border region of a type where two color regions which are small in brightness difference and large in chromaticity difference are positioned side by side are changed to new values different from those represented by the image signal components for the pixels of the color image signal, and

a monochromatic image signal is generated with values of brightness of pixels in the color border region set to said new values and values of brightness of pixels in regions other than the color border region set to those as represented by the image signal components for the pixels of the color image signal.

2. An image processing method of making a monochromatic image signal made up of image signal components representing image data on respective pixels from a color image signal made up of image signal components representing image data on respective pixels, the method comprising

the step of determining whether a designated pixel is a pixel in a color border region of a type where two color regions which are small in brightness difference and large in

chromaticity difference are positioned side by side on the basis of the difference in value of brightness between the designated pixel and neighbor pixels near the designated pixel and the difference in value of chromaticity between the designated pixel and the neighbor pixels,

the steps of, when the designated pixel is determined to be a pixel in a color border region of said type, obtaining the values of brightness and chromaticity of at least two colors representative of colors forming the color border on the basis of the values of brightness and chromaticity of the neighbor pixels, and changing the value of brightness of the designated pixel to a new value different from that represented by the image signal component for the pixel of the color image signal on the basis of the values of brightness and chromaticity of the designated pixel as represented by the image signal component for the pixel of the color image signal, the values of brightness and chromaticity of the respective representative colors and a preset order of priority of colors, and

the step of making a monochromatic image signal by setting values of brightness of pixels in the color border region to said new values and setting values of brightness of pixels in regions other than the color border region to those as represented by the image signal components for the pixels of the color image signal.

3. An imaging processing method as defined in Claim 2 in which, when the designated pixel is determined to be a pixel

in a color border region of said type, the value of brightness of each pixel in a predetermined region about the designated pixel is changed to a value different from that represented by the image signal component for the pixel of the color image signal on the basis of the values of brightness and chromaticity of the pixel, the values of brightness and chromaticity of the respective representative colors and a preset order of priority of colors.

4. An image processing method of making a monochromatic image signal made up of image signal components representing image data on respective pixels from a color image signal made up of image signal components representing image data on respective pixels, the method comprising

the steps of dividing the color image signal into a plurality of blocks of a predetermined size, and determining the values of brightness and chromaticity of each block on the basis of the values of brightness and chromaticity of each pixel in the block represented by image signal components for the pixel of the color image signal,

the step of determining whether a designated block is a block in a color border region of a type where two color regions which are small in brightness difference and large in chromaticity difference are positioned side by side on the basis of the difference in value of brightness between the designated block and neighbor blocks near the designated block and the difference in value of chromaticity between the designated block

and the neighbor blocks,

the steps of, when the designated block is determined to be a block in a color border region of said type, obtaining the values of brightness and chromaticity of at least two colors representative of colors forming the color border on the basis of the values of brightness and chromaticity of the neighbor blocks, and changing the value of brightness of each pixel in the designated block to a new value different from that represented by the image signal component for the pixel of the color image signal on the basis of the values of brightness and chromaticity of the pixel, the values of brightness and chromaticity of the respective representative colors and a preset order of priority of colors, and

the step of making a monochromatic image by setting values of brightness of pixels in the block in the color border region to said new values and setting values of brightness of pixels in the blocks in regions other than the color border region to those as represented by the image signal components for the pixels of the color image signal.

5. An image processing apparatus for making a monochromatic image signal made up of image signal components representing image data on respective pixels from a color image signal made up of image signal components representing image data on respective pixels, the apparatus characterized by having a color border enhancement processing means which changes values of brightness of pixels in a color border region of a

type where two color regions which are small in brightness difference and large in chromaticity difference are positioned side by side to new values different from those represented by the image signal components for the pixels of the color image signal and

a monochromatic image signal generating means which makes a monochromatic image signal by setting values of brightness of pixels in the color border region to said new values and setting values of brightness of pixels in regions other than the color border region to those as represented by the image signal components for the pixels of the color image signal.

6. An image processing apparatus for making a monochromatic image signal made up of image signal components representing image data on respective pixels from a color image signal made up of image signal components representing image data on respective pixels comprising

a color border determining means which determines whether a designated pixel is a pixel in a color border region of a type where two color regions which are small in brightness difference and large in chromaticity difference are positioned side by side on the basis of the difference in value of brightness between the designated pixel and neighbor pixels near the designated pixel and the difference in value of chromaticity between the designated pixel and the neighbor pixels,

a representative color determining means which obtains the values of brightness and chromaticity of at least two colors

representative of colors forming the color border concerning the designated pixel determined to be a pixel in the color border region on the basis of the values of brightness and chromaticity of the neighbor pixels,

5 a color border enhancing brightness calculating means which changes the value of brightness of the designated pixel determined to be a pixel in the color border region to a new value different from that represented by the image signal component for the pixel of the color image signal on the basis
10 of the values of brightness and chromaticity of the designated pixel as represented by the image signal component for the pixel of the color image signal, the values of brightness and chromaticity of the respective representative colors and a preset order of priority of colors, and

15 a monochromatic image signal generating means which generates a monochromatic image signal by setting values of brightness of pixels in the color border region to said new values and setting values of brightness of pixels in regions other than the color border region to those as represented by
20 the image signal components for the pixels of the color image signal.

7. An image processing apparatus as defined in Claim
6 in which the color border enhancing brightness calculating means changes the value of brightness of each pixel in a
25 predetermined region about the designated pixel to a new value different from that represented by the image signal component

for the pixel of the color image signal on the basis of the values of brightness and chromaticity of the pixel, the values of brightness and chromaticity of the respective representative colors and a preset order of priority of colors when the designated pixel is determined to be a pixel in the color border region of said type, and the monochromatic image signal determining means generates a monochromatic image signal by setting values of brightness of pixels in the predetermined region to said new values.

8. An image processing apparatus as defined in Claim 6 in which the color border determining means determines that the designated pixel is a pixel in a color border region of said type when there is at least one pixel in the neighbor pixels whose difference in brightness from that of the designated pixel is smaller than a first threshold value and whose difference in chromaticity from that of the designated pixel is larger than a second threshold value.

9. An image processing apparatus as defined in Claim 6 in which the representative color determining means calculates the differences in chromaticity between a pixel in the neighbor pixels whose difference in brightness from that of the designated pixel is smaller than a first threshold value and whose difference in chromaticity from that of the designated pixel is larger than a second threshold value and the other pixels in the neighbor pixels, and takes as the values of chromaticity of the representative colors the values of chromaticity of a

pair of pixels which give a maximum difference in chromaticity.

10. An image processing apparatus as defined in Claim 6 in which the color border enhancing brightness calculating means determines which of the representative colors the color of the designated pixel belongs to on the basis of the values of brightness and chromaticity of the designated pixel and the values of brightness and chromaticity of each of the representative colors, changes the value of brightness of the designated pixel to a new value by adding a predetermined constant to that represented by the image signal component for the pixel of the color image signal when the representative color to which the color of the designated pixel belongs is higher in the order of priority of colors than the other representative color, and changes the value of brightness of the designated pixel to a new value by subtracting a predetermined constant from that represented by the image signal component for the pixel of the color image signal when the representative color to which the color of the designated pixel belongs is lower in the order of priority of colors than the other representative color.

11. An image processing apparatus as defined in Claim 10 in which the color border enhancing brightness calculating means determines which of the representative colors the color of each pixel in a predetermined region belongs to on the basis of the values of brightness and chromaticity of the pixel and the values of brightness and chromaticity of each of the

representative colors, changes the value of brightness of the pixel to a new value by adding a predetermined constant to that represented by the image signal component for the pixel of the color image signal when the representative color to which the color of the pixel belongs is higher in the order of priority of colors than the other representative color, and changes the value of brightness of the designated pixel to a new value by subtracting a predetermined constant from that represented by the image signal component for the pixel of the color image signal when the representative color to which the color of the pixel belongs is lower in the order of priority of colors than the other representative color.

12. An image processing apparatus as defined in Claim 6 in which the order of priority of colors is in the order of white, yellow, cyan, magenta, red, green, blue, black or in the order of the values of brightness of the representative colors.

13. An image processing apparatus for making a monochromatic image signal made up of image signal components representing image data on respective pixels from a color image signal made up of image signal components representing image data on respective pixels comprising

a block brightness/chromaticity calculating means which divides the color image signal into a plurality of blocks of a predetermined size and determines the values of brightness and chromaticity of each block on the basis of the values of

brightness and chromaticity of each pixel in the block represented by image signal components for the pixel of the color image signal,

a color border determining means which determines whether
5 a designated block is a block in a color border region of a type where two color regions which are small in brightness difference and large in chromaticity difference are positioned side by side on the basis of the difference in value of brightness between the designated block and neighbor blocks near the
10 designated block and the difference in value of chromaticity between the designated block and the neighbor blocks,

a representative color determining means which obtains the values of brightness and chromaticity of at least two colors representative of colors forming the color border concerning
15 the designated block determined to be a block in the color border region on the basis of the values of brightness and chromaticity of the neighbor blocks,

a color border enhancing brightness calculating means which changes the value of brightness of each of the pixels
20 in the block determined to be a block in the color border region to a new value different from that represented by the image signal component for the pixel of the color image signal on the basis of the values of brightness and chromaticity of the pixel as represented by the image signal component for the pixel
25 of the color image signal, the values of brightness and chromaticity of the respective representative colors and a

preset order of priority of colors, and

a monochromatic image signal generating means which generates a monochromatic image signal by setting values of brightness of pixels in the color border region to said new values and setting values of brightness of pixels in regions other than the color border region to those as represented by the image signal components for the pixels of the color image signal.

14. An image processing apparatus as defined in Claim 13 in which the color border determining means determines that the designated block is a block in a color border region of said type when there is at least one block in the neighbor blocks whose difference in brightness from that of the designated block is smaller than a first threshold value and whose difference in chromaticity from that of the designated block is larger than a second threshold value.

15. An image processing apparatus as defined in Claim 13 in which the representative color determining means calculates the differences in chromaticity between a block in the neighbor blocks whose difference in brightness from that of the designated block is smaller than a first threshold value and whose difference in chromaticity from that of the designated pixel is larger than a second threshold value and the other blocks in the neighbor blocks, and takes as the values of chromaticity of the representative colors the values of chromaticity of a pair of blocks which give a maximum difference

in chromaticity.

16. An image processing apparatus as defined in Claim 13 in which the color border enhancing brightness calculating means determines which of the representative colors the color of each pixel in the block determined to be a block in a color border region belongs to on the basis of the values of brightness and chromaticity of the pixel and the values of brightness and chromaticity of each of the representative colors, changes the value of brightness of the pixel to a new value by adding a predetermined constant to that represented by the image signal component for the pixel of the color image signal when the representative color to which the color of the pixel belongs is higher in the order of priority of colors than the other representative color, and changes the value of brightness of the pixel to a new value by subtracting a predetermined constant from that represented by the image signal component for the pixel of the color image signal when the representative color to which the color of the pixel belongs is lower in the order of priority of colors than the other representative color.

17. An image processing apparatus as defined in Claim 13 in which the order of priority of colors is in the order of white, yellow, cyan, magenta, red, green, blue, black or in the order of the values of brightness of the representative colors.